

Advanced Mathematics

UGRA_015722

Departments	Dept. of Operations, Innovation & Data Sciences
Teaching Languages	English
ECTS	6
Teacher responsible	Oltean Marius - marius.oltean@esade.edu

Course Goals

After completing this course, students will be able to:

- Apply a wide variety of advanced mathematical concepts including modular arithmetic, vector spaces and bases, series, numerical approximations of functions, and differential equations.
- Connect advanced mathematical methods to concepts and problems in data analytics, cryptography, economics, and finance.
- Fluently interplay between performing calculations by hand and employing mathematical software as part of day-to-day problem solving.

Previous knowledge

Knowledge of all the concepts covered in "Applied Mathematics for Management" (Matrices; Diagonalization; Dot Products; Limits, Continuity and Derivatives; Taylor Approximations and Single Integrals; Two Variable Functions; Partial Derivatives; Unconstrained Optimization; Constrained Optimization; Double Integrals) is required.

Teaching methodology

To achieve the objectives of the course, the course sessions will be of the following types:

- **Lectures** dedicated to the theoretical exposition of the main concepts of each topic
- **Participatory sessions:** Students will work on problems in randomly assigned teams.

Description

Course contribution to program

This course is strongly motivated by applications in data analytics, cryptography, economics, and finance, and will develop both personal analytical skill and the use of mathematical software for practical problem solving. It will further enrich and solidify the connections between concepts that students have previously learned in their introductory Applied Mathematics for Management course. It will prepare students for future study in the fields of data science, machine learning, cryptography and quantitative finance.

Short description

This is a course on Advanced Mathematics, covering discrete mathematics, advanced linear algebra, approximation methods and advanced calculus.

Bibliography

William J. Gilbert and Scott A. Vanstone, Introduction to Mathematical Thinking: Algebra and Number Systems, Pearson (Book)

Daniel Norman and Dan Wolczuk, An Introduction to Linear Algebra for Science and Engineering (3rd Edition), Pearson (Book)

Richard L. Burden, Douglas J. Faires and Annette M. Burden, Numerical Analysis, Cengage Learning (Book)

Knut Sydsaeter, Peter Hammond, Atle Seierstad and Arne Strom, Further Mathematics for Economic Analysis (2nd Edition), Pearson (Book)

Content

#	Topic
1	UNIT 1. Discrete Mathematics. Modular Arithmetic, Introduction to Cryptography.
2	UNIT 2. Advanced Linear Algebra. Vector Spaces, Orthonormal Bases.
3	UNIT 3. Approximation Methods. Series, Numerical Analysis, Numerical Optimization.
4	UNIT 4. Advanced Calculus. Ordinary Differential Equations , Partial Differential Equations.

Assessment

Tool	Assessment tool	Category	Weight %
Written and/or oral exams		Ordinary round	50.00%
Written and/or oral exams		Retake	50.00%
Individual or team exercises		Ordinary round	50.00%
Attendance and punctuality	Attendance. In accordance with ESADE regulations, attendance is mandatory for this course. Students who fail to attend 80% of the course will not be allowed to pass and will be required to sit the retake exam.	Ordinary round	0.00%

PROGRAMS

DBAI21-Double Degree in Business Administration and Artificial Intelligence for Business (Undergraduates: Business)
DBAI21 Year 1 (Mandatory)

DBAI23-Double Degree in Business Administration and Artificial Intelligence for Business (Undergraduates: Business)
DBAI23 Year 1 (Mandatory)